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RAPID COLONIZATION OF THE WESTERN UNITED STATES BY
THE PALEARCTIC MOTH, *AGONOPTERIX ALSTROEMERIANA*
(OECOPHORIDAE)

Additional key words: Apiaceae, *Conium*, Gelechioidea, introduced insect.

Larvae of *Agonopterix alstroemeriana* (Clerck) (Oecophoridae) (Figs. 1, 2), which live in conspicuous leaf rolls on Poison Hemlock (*Conium maculatum* L., Apiaceae = Umbelliferae), were discovered in Tompkins County, New York (Berenbaum, M. & S. Passoa 1983, J. Lepid. Soc. 37:38). The species was assumed to have recently immigrated to North America because no records were known before 1973 (Hodges, R. W. 1974, Moths of America north of Mexico, fasc. 6.2, Gelechioidea, Oecophoridae, 142 pp.). The earliest record we have seen is 24 June 1973, at Elm St. Ext. Coy Glen near Ithaca, Tompkins Co., New York. However, one might expect a new colonist to appear near a port of entry or major international airport, such as Buffalo, Erie, the New York City area, or along the St. Lawrence River, rather than 300 km inland. Hence, *A. alstroemeriana* populations may have existed elsewhere in the northeastern U.S.A. prior to discovery in the Ithaca area. There are lengthy gaps in the record of establishment and spread of other introduced moths in populous North American regions of both coasts (Powell, J. A. & J. M. Burns 1971, Psyche 78:38; Powell, J. A. 1989, Pan-Pacific Entomol. 64:98).

Nevertheless, there are numerous records documenting the amazingly synchronous appearance of *A. alstroemeriana* in widespread parts of the western Nearctic. The species was detected in California, Oregon, and Utah in 1983. During that season it appeared on both sides of San Francisco Bay, at Berkeley and San Bruno Mountain, localities that had been regularly sampled during the preceding several years by Powell and R. L. Langston. So rapid was the spread of this species throughout the western U.S. that we can reconstruct neither direction of expansion nor avenue of entry. We suspect this moth invaded the western Nearctic by direct introduction, either from Europe or from the northeastern U.S. Overland expansion of its range from the east seems unlikely because a survey of *Conium maculatum* insects in Illinois during several seasons (1986-89) by Passoa failed to reveal larvae of *A. alstroemeriana*, and we did not find any records in the midwest states prior to collection of an adult near Columbus, Ohio, in June, 1990, by Powell. The records suggest colonizations in the Columbia River (Oregon) area, the Puget Sound (Washington) area, or both, and independently in the San Francisco Bay area.

Moths of the genus *Agonopterix* characteristically are secretive, hiding in dark corners and crevices, rather than flying to lights when disturbed. The larvae feed in spring and early summer, adult emergence occurs soon thereafter, and the moths aestivate and hibernate prior to oviposition in early spring. Hence, on the Pacific Coast, adults of *A. alstroemeriana* may be encountered during any month between late June and March. Their habits and longevity therefore make them likely candidates for transport by man as stowaways on ships, trucks, etc., during aestivation or hibernation.

By 1987, *A. alstroemeriana* occurred throughout many non-arid parts of the west, in Colorado, Utah, Idaho, Washington, Oregon, and northern California (Fig. 3), following its hostplant, which has been a widely naturalized weed for many decades (Robbins, W. W. 1940, Calif. Agr. Exp. Sta. Bull. 637). R. D. Goeden and D. W. Ricker (1982, Ann. Entomol. Soc. Amer. 75:173) did not find this moth in their extensive survey of insects feeding on *Conium maculatum* in southern California during 1978 and 1979, and we do not know of any collections subsequently (through 1990), although colonization there is probable. We have not seen records of *A. alstroemeriana* in Canada, but establishment around Vancouver and southern Ontario is likely.

Western U.S. material examined.—CALIFORNIA: Alameda Co.: Albany VII-5-85, I-30-86 (J. W. Brown, UCB); Aquatic Park, Berkeley V-22-83, larvae on *Conium maculatum* (P. Neyman, UCB); north Berkeley III-10-84 and subsequent dates, at light (J. Powell, UCB); Strawberry Cyn., Berkeley Hills VI-27-87 (S. Passoa, SPC), Fairmount Ridge SE



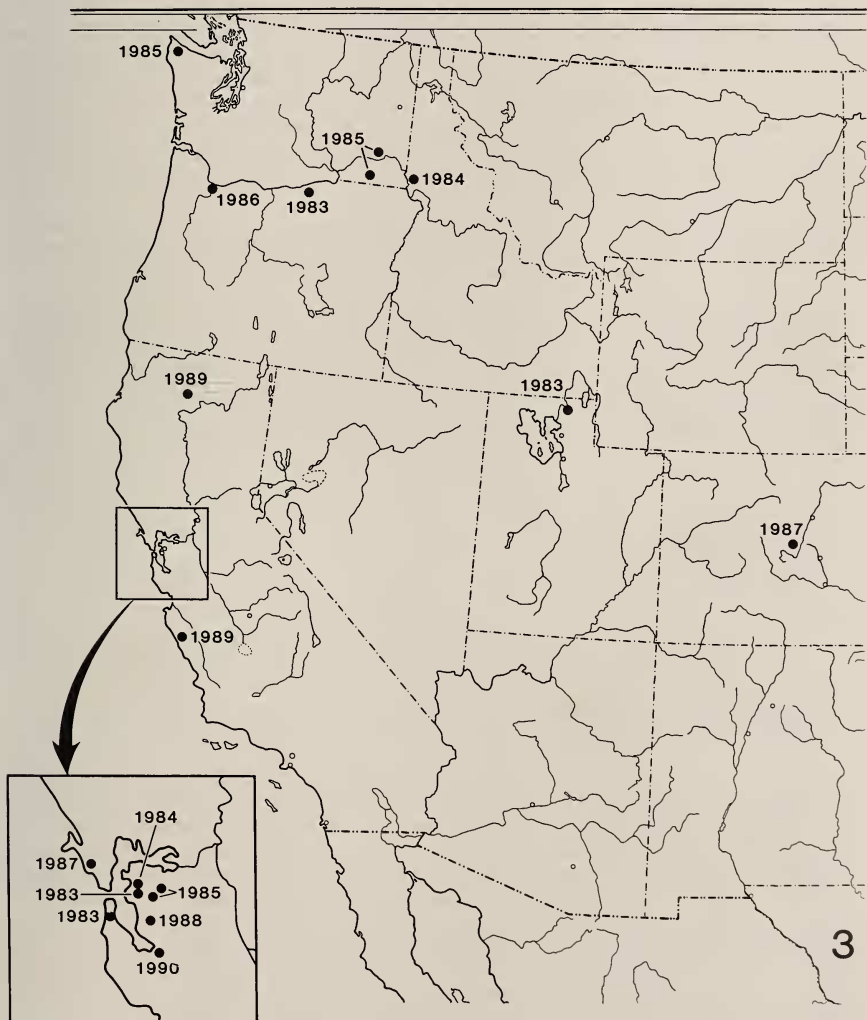
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FIG. 1. Adult of *Agonopterix alstroemeriana*, Berkeley, California (scale bar in mm).

FIG. 2. Final instar larvae of *A. alstroemeriana*, Hooper, Whitman Co., Washington.



3

FIG. 3. Locality records for *Agonopterix alstroemeriana* in the western United States, with year of first capture.

of San Leandro II-10-88 (Powell, UCB). Contra Costa Co.: Orinda VII-3/11-85 (C. D. MacNeill, OM); Russell Reserve N of Lafayette X-22-85 (Brown & Powell, UCB). Marin Co.: Audubon Cyn. nr. Bolinas V-17-87, larvae on *C. maculatum* (R. Peterson, photo UCB.) Monterey Co.: Big Creek Reserve X-7 to XI-10-89 (F. Arias, BCR, UCB). San Mateo Co.: San Bruno Mt. XI-28-83 and later dates (R. Langston, CAS, RLC) and reared from larvae on *C. maculatum* IV-86 (JAP 86D1), V-86 (JAP 86E12), III-87 (JAP 87C56) (J. De Benedictis, UCB). Santa Clara Co.: nr. Milpitas IV-25-90, larvae on *C. maculatum* (L. Spahr, UCB). Siskiyou Co.: Mt. Shasta City VI-9-89, larvae on *C. maculatum* (B. Villegas, CDFA). COLORADO: No. Platte, 6600' [1980 m] Jefferson Co. VIII-20-87, at light (P. A. Opler, UCB). IDAHO: 5 mi. [8 km] SW Cul de Sac, Nez Perce Co. VII-10-84, reared from *C. maculatum* (F. Merickel, USNM). OREGON: Morrow Co. VI-14-83 (no collr. given, USNM). Multnomah Co.: Hayden Isl., Portland IX-19-86 (Powell, UCB), UTAH: Cache Co.: Hyrum St. Park VIII-5-86 (Passoa, SPC); Logan X-1-83 (D. Veirs, UCB). WASHINGTON: Walla Walla Co.: Walla Walla VI-6-85, reared from *C. maculatum* (no collr. given, USNM). Whatcom Co.: Blaine V-30-85, larvae on *C. maculatum* (Passoa, SPC). Whitman Co.: Hooper V-30-85, larvae on *C. maculatum* (S. Passoa, UCB). (CAS = California Academy of Sciences, San Francisco; CDFA = Calif. Dept. Food & Agric., Sacramento; OM = Oakland Museum, Oakland, California; RLC = R. Langston collection, Kensington, California; SPC = S. Passoa Collection, Reynoldsburg, Ohio; UCB = Essig Museum of Entomology, U. Calif. Berkeley; USNM = U.S. National Museum of Nat. Hist., Washington, D.C.).

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COLD HARDINESS OF *HYALOPHORA EURYALUS KASLOENSIS* (SATURNIIDAE) FROM THE OKANAGAN VALLEY, BRITISH COLUMBIA

Additional key words: supercooling, freezing tolerance, overwintering, cocoons.

Overwintering temperate zone insects that are not freezing tolerant (able to survive formation of ice in extracellular body fluids) must avoid freezing to survive. They do so by lowering the freezing point of their body fluids (supercooling), as low as -53°C in some species (Somme, L. 1982, *Comp. Biochem. Physiol.* 73A:519-543), with the aid of biochemical antifreezes such as sugar alcohols and thermal hysteresis proteins. Also, to avoid freezing, some insects seek sheltered microhabitats or construct elaborate cocoons, or both, in preparation for overwintering; such activities may also provide protection from predators while the overwintering insect is immobile (Danks, H. V. 1978, *Can. Entomol.* 110:1167-1205). The three species (*sensu* Lemaire, C. 1978, *The Attacidae of America. Attacinae*, Edition C. Lemaire, 42 Boulevard Victor Hugo, Neuilly-sur-Seine, France, pp. 114-125) of the North American genus *Hyalophora* Duncan (Saturniidae) are large univoltine moths that overwinter as diapausing pupae within well-constructed double cocoons. The well-known species *H. cecropia* (L.) has been the subject of a variety of ecological, behavioral, and physiological studies and is known to be freezing tolerant